

What is claimed is:

1. A cleaning method in a semiconductor fabrication process, comprising the steps of:

5 providing a dilute composition consisting essentially of phosphoric acid and acetic acid; and

exposing a surface to the dilute composition.

10 2. The method of claim 1, wherein the dilute composition includes phosphoric acid at a concentration of about 5% or less by volume and acetic acid at a concentration of about 30% or less by volume.

15 3. The method of claim 2, wherein the composition includes phosphoric acid at a concentration of about 5% or less by volume and acetic acid at a concentration of about 10% or less by volume.

20 4. The method of claim 2, wherein exposing the surface includes immersing the surface in the dilute composition for a time period in the range of about 15 seconds to about 10 minutes.

5. The method of claim 4, wherein exposing the surface includes immersing the surface in the dilute composition for a time period in the range of about 15 seconds to about 90 seconds.

25 6. The method of claim 2, wherein the dilute composition includes phosphoric acid at a concentration of about 5% or less by volume and acetic acid at a concentration in the range of about 20% by volume to about 30% by volume.

30 7. The method of claim 6, wherein exposing the surface includes immersing the surface in the dilute composition for a time period in the range of about 15 seconds to about 60 seconds.

8. The method of claim 1, wherein the dilute composition is heated to a temperature of less than about 50 degrees Celsius.

5 9. The method of claim 8, wherein the dilute composition is heated to a temperature of about 30 to about 45 degrees Celsius.

10. The method of claim 1, wherein the surface is of a conductive layer.

10 11. The method of claim 10, wherein the method further includes etching a material resulting in metallized organic residue on at least a part of the surface, and further wherein the exposing step includes removing the metallized organic residue.

12. The method of claim 10, wherein the exposing step includes etching the conductive layer at a rate of less than about 200 Å/minute.

15 13. The method of claim 12, wherein the exposing step includes etching the conductive layer at a rate of less than about 50 Å/minute.

14. The method of claim 10, wherein the exposing step includes etching the conductive layer such that less than about 500 Å of conductive material is removed from the conductive layer during an exposure period of less than 10 minutes.

15. The method of claim 14, wherein the exposing step includes etching the conductive layer such that less than about 200 Å of conductive material is removed from the conductive layer during an exposure period of less than 10 minutes.

16. The method of claim 15, wherein the exposing step includes etching the conductive layer such that less than about 50 Å of conductive material is removed from the conductive layer during an exposure period of less than 10 minutes.

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17. A cleaning method in a semiconductor fabrication process, the method comprising the steps of:
providing a composition comprising phosphoric acid and acetic acid, wherein the composition includes phosphoric acid at a concentration of X%, wherein X is about 5% by volume or less, and acetic acid at a concentration of about (100-X%) by volume or less; and
exposing a surface to the composition.
18. The method of claim 17, wherein the composition is a dilute composition, wherein the dilute composition includes phosphoric acid at a concentration of about 5% by volume or less, acetic acid at a concentration of about 30% by volume or less, and deionized water.
19. The method of claim 17, wherein exposing the surface includes immersing the surface in the composition for a time period in the range of about 15 seconds to about 10 minutes.
20. The method of claim 17, wherein the composition is heated to a temperature of less than about 50 degrees Celsius.
21. The method of claim 20, wherein the composition is heated to a temperature of about 30 to about 45 degrees Celsius.
22. The method of claim 17, wherein the surface is of a conductive layer.
23. The method of claim 22, wherein the method further includes etching a material resulting in metallized organic residue on at least a part of the surface, and further wherein the exposing step includes removing the metallized organic residue.
24. The method of claim 22, wherein the exposing step includes etching the conductive layer at a rate of less than about 200 Å/minute.

25. The method of claim 24, wherein the exposing step includes etching the conductive layer at a rate of less than about 50 Å/minute.

5 26. The method of claim 22, wherein the exposing step includes etching the conductive layer such that less than about 500 Å of conductive material is removed from the conductive layer during an exposure time period less than about 10 minutes.

10 27. The method of claim 26, wherein the exposing step includes etching the conductive layer such that less than about 200 Å of conductive material is removed from the conductive layer during an exposure time period less than about 10 minutes.

15 28. The method of claim 27, wherein the exposing step includes etching the conductive layer such that less than about 50 Å of conductive material is removed from the conductive layer during an exposure time period less than about 10 minutes.

29. A method of fabricating an interconnect structure, the method comprising the steps of:

20 patterning a conductive layer; and
cleaning the conductive layer using a composition comprising phosphoric acid and acetic acid, wherein the composition includes phosphoric acid at a concentration of about X% or less by volume, where X is 5, and acetic acid at a concentration of about (100-X)% or less by volume.

25 30. The method of claim 29, wherein composition is a dilute composition, and further wherein the dilute composition includes phosphoric acid at a concentration of about 5% or less by volume and acetic acid at a concentration of about 30% or less by volume.

31. The method of claim 30, wherein the dilute composition includes phosphoric acid at a concentration of about 5% or less by volume and acetic acid at a concentration of about 10% or less by volume.
- 5 32. The method of claim 30, wherein cleaning the conductive layer includes immersing the conductive layer in the dilute composition for a time period in the range of about 15 seconds to about 10 minutes.
- 10 33. The method of claim 32, wherein cleaning the conductive layer includes immersing the conductive layer in the dilute composition for a time period in the range of about 15 seconds to about 90 seconds.
34. The method of claim 29, wherein the composition is heated to a temperature of less than about 50 degrees Celsius.
- 15 35. The method of claim 34, wherein the composition is heated to a temperature of about 30 to about 45 degrees Celsius.
- 20 36. The method of claim 29, wherein the patterning step includes etching the conductive layer resulting in metallized organic residue on at least a part of the conductive layer, and further wherein the cleaning step includes removing the metallized organic residue.
- 25 37. The method of claim 29, wherein the cleaning step includes etching the conductive layer at a rate of less than about 200 Å/minute.
38. The method of claim 37, wherein the cleaning step includes etching the conductive layer at a rate of less than about 50 Å/minute.

39. The method of claim 29, wherein the cleaning step includes etching the conductive layer such that less than about 500 Å of conductive material is removed from the conductive layer over a cleaning time period of less than about 10 minutes.

5 40. The method of claim 39, wherein the cleaning step includes etching the conductive layer such that less than about 200 Å of conductive material is removed from the conductive layer over a cleaning time period of less than about 10 minutes.

10 41. The method of claim 40, wherein the cleaning step includes etching the conductive layer such that less than about 50 Å of conductive material is removed from the conductive layer over a cleaning time period of less than about 10 minutes.

42. The method of claim 29, wherein the conductive layer comprises aluminum.

15 43. The method of claim 42, wherein the patterning step includes patterning the conductive layer using a chlorine-containing etchant and a photoresist resulting in organic residue on at least a part of the conductive layer, and further wherein the cleaning step includes removing the organic residue.

20 44. The method of claim 43, wherein the organic residue is metallized organic residue.

45. A method of fabricating a multilevel interconnect structure, the method comprising the steps of:
25 providing an insulating layer over a first metal layer;
defining a via in the insulating layer, resulting in residue on an exposed portion of the first metal layer; and
removing the residue using a dilute cleaning composition consisting essentially of phosphoric acid and acetic acid, wherein the dilute cleaning composition
30 includes phosphoric acid at a concentration of about 5% or less by volume and acetic acid at a concentration in the range of about 20% by volume to about 30% by volume.

46. The method of claim 45, wherein removing the residue includes immersing the surface in the dilute cleaning composition for a time period in the range of about 15 seconds to about 60 seconds.

5 47. The method of claim 45, wherein the dilute cleaning composition is heated to a temperature of less than about 50 degrees Celsius.

48. The method of claim 47, wherein the dilute cleaning composition is heated to a temperature of about 30 to about 45 degrees Celsius.

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49. The method of claim 45, wherein the removing step includes etching the first metal layer at a rate of less than about 200 Å/minute.

15 50. The method of claim 49, wherein the removing step includes etching the first metal layer at a rate of less than about 50 Å/minute.

51. The method of claim 45, wherein the removing step includes etching the first metal layer such that less than about 500 Å of conductive material is removed from the first metal layer during immersion in the dilute cleaning composition for a time period of about 15 second to about 60 seconds.

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52. The method of claim 51, wherein the removing step includes etching the first metal layer such that less than about 200 Å of conductive material is removed from the first metal layer during immersion in the dilute cleaning composition for a time period of 15 second to 60 seconds.

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53. The method of claim 52, wherein the removing step includes etching the first metal layer such that less than about 50 Å of conductive material is removed from the first metal layer during immersion in the dilute cleaning composition for a time period of 15 second to 60 seconds.

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54. The method of claim 45, wherein the step of defining the via includes patterning the insulating layer using photoresist and a fluorine-containing etchant.

55. The method of claim 54, wherein the residue includes metallized organic residue.

56. A cleaning method in a semiconductor fabrication process, the method comprising the steps of:

10 providing a structure including an aluminum containing conductive region;
providing a dilute composition consisting essentially of phosphoric acid,
acetic acid, and deionized water; and
exposing the structure to the dilute composition to clean at least the aluminum containing conductive region.

15 57. The method of claim 56, wherein the dilute composition includes phosphoric acid at a concentration of about 5% or less by volume and the acetic acid at a concentration of about 30% or less by volume.

58. The method of claim 56, wherein providing the structure includes etching a
20 material resulting in metallized organic residue on at least a part of the aluminum containing conductive region, and further wherein the exposing step includes removing the metallized organic residue.

59. The method of claim 56, wherein the exposing step includes etching the
25 aluminum containing conductive region at a rate of less than about 200 Å/minute.

60. The method of claim 59, wherein the exposing step includes etching the aluminum containing conductive region at a rate of less than about 50 Å/minute.

30 61. The method of claim 56, wherein the exposing step includes etching the aluminum containing conductive region such that less than about 500 Å of the

aluminum containing conductive region is removed during an exposure time period of less than about 10 minutes.

5 62. The method of claim 61, wherein the exposing step includes etching the aluminum containing conductive region such that less than about 200 Å of the aluminum containing conductive region is removed during an exposure time period of less than about 10 minutes.

10 63. The method of claim 62, wherein the exposing step includes etching the aluminum containing conductive region such that less than about 50 Å of aluminum containing conductive region is removed during an exposure time period of less than about 10 minutes.

15 64. A cleaning composition for use in semiconductor integrated circuit fabrication, the cleaning composition consisting essentially of a dilute aqueous solution of phosphoric acid and acetic acid, wherein the phosphoric acid is of a concentration of about 5% by volume or less and the acetic acid is of a concentration of about 30% by volume or less.

20 65. The cleaning composition of claim 64, wherein the phosphoric acid is of a concentration of about 5% or less by volume and the acetic acid of a concentration of about 10% or less by volume.

25 66. The cleaning composition of claim 64, wherein the phosphoric acid is of a concentration of about 5% or less by volume and the acetic acid is of a concentration in the range of about 20% by volume to about 30% by volume.

30 67. A cleaning composition for use in semiconductor integrated circuit fabrication comprising phosphoric acid and acetic acid, wherein the composition includes phosphoric acid at a concentration of about X% by volume or less, where X is 5, and acetic acid at a concentration of about (100-X)% by volume or less.

68. The cleaning composition of claim 67, wherein the composition is a dilute composition, wherein the dilute composition includes phosphoric acid at a concentration of about 5% by volume or less, acetic acid at a concentration of about 30% by volume or less, and deionized water.

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69. The cleaning composition of claim 68, wherein the dilute composition includes phosphoric acid at a concentration of about 5% by volume or less, acetic acid at a concentration of about 10% by volume or less, and deionized water.

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70. The cleaning composition of claim 68, wherein the dilute composition includes phosphoric acid at a concentration of about 5% by volume or less, acetic acid at a concentration in the range of about 20% by volume to about 30% by volume, and deionized water.